



## ***Scale Models of the Solar System***

### **DESCRIPTION**

This lesson allows students to visualize the comparative sizes and distances of solar system bodies by making solar system objects to scale using common objects, walking off the distances between planets, and participating in a Web-based Sun/Earth scale model activity.

### **OBJECTIVES**

Students will

- Demonstrate the size of the Sun and the bodies of the solar system on the ten-billionth scale.
- Construct and walk the distances between the bodies of the solar system on the ten-billionth scale.
- Compare the temperature, diameter, and distance to the Sun with familiar things on Earth.

### **NASA SUMMER OF INNOVATION UNIT**

*Earth and Space Science—Year of the Solar System*

### **GRADE LEVELS**

7 – 9

### **CONNECTION TO CURRICULUM**

*Science, Mathematics, and Technology*

### **TEACHER PREPARATION TIME**

3 Hours

### **LESSON TIME NEEDED**

3 Hours

*Complexity: Moderate*

### **NATIONAL STANDARDS**

#### **National Science Education Standards (NSTA)**

*Earth and Space Science*

- Earth in the Solar System

#### **Common Core State Standards for Mathematics (NCTM)**

*Ratios and Proportional Relationships*

- Understand ratio concepts and use ratio reasoning to solve problems

#### **ISTE NETS and Performance Indicators for Students (ISTE)**

*Creativity and Innovation*

- Use models and simulations to explore complex systems and issues

*Research and Information Fluency*

- Process data and report results

*Technology Operations and Concepts*

- Understand and use technology systems

## MANAGEMENT

These three activities the students can present on their own or as one integrated lesson. They will work together well as an integrated unit because one activity is Web based, one is hands on, and the third is outside and requires the students to walk a short distance.

- For Exploring Planet Sizes, make copies of the student work sheet. Prepare a master set of Model Planet Cards using the correct foods to use in Walking Planet Distances. Do NOT hand out Model Planet Cards until teams finish the first Student Worksheet.
- For Walking Planet Distances, find an outside area to walk 600 paces (0.4 miles) in a somewhat straight line. If possible, get 10 helium balloons to mark the position of the planets.
- For Solar Pizza, you will need Internet access, preferably a computer lab.

## CONTENT RESEARCH

### Key Terms

**Solar System**—The collection of planets and their moons in orbit around the Sun, together with smaller bodies such as asteroids, meteoroids, and comets.

**Planet**—Celestial body that is in orbit around the Sun, has sufficient mass to assume a round shape, and has cleared the neighborhood around its orbit.

**Comet**—Celestial object consisting of a nucleus of ice and dust and, when near the Sun, a “tail” of gas and dust particles pointing away from the Sun.

**Sun**—The star around which the Earth orbits.

### LESSON ACTIVITIES

**Exploring Planet Sizes**—This activity looks at the sizes of the planets and takes place in the classroom. Students predict the size of Earth and Jupiter and find foods (like cereal, gum balls, etc.) that are about the size of each planet. <http://solarsystem.nasa.gov/educ/docs/3-stardst-ch03.pdf>

**Walking Planet Distances**—This activity requires the class to go outside to walk the distances between the planets. <http://solarsystem.nasa.gov/educ/docs/3-stardst-ch03.pdf>

**Solar Pizza**—Students compare the temperature, diameter, and distance to the Sun with familiar things on Earth. <http://solar-center.stanford.edu/compare/>

### ADDITIONAL RESOURCES

- **Solar System Exploration:** Any and everything you want to know about the solar system. <http://solarsystem.nasa.gov/index.cfm>
- **Stanford Solar Center, Educator Page:** Any and everything you want to know about the Sun. <http://solar-center.stanford.edu/teachers/>

### MATERIALS

- Balloon (for the model Sun)
- Metric ruler
- Miniature marshmallows
- Poppyseeds
- Mustard seeds
- Circle-shaped cereal
- Popcorn kernels
- Dried peas
- 1-centimeter gum balls
- Black pepper
- Glue
- Model Planet Cards
- Voyage of Discovery Work sheet
- Pins or masking tape
- Pencil
- Hard writing surface (to take outside)

## DISCUSSION QUESTIONS

- What is the biggest thing you have ever touched? *Earth*
- If the Sun is so much bigger than the Moon, why does it appear the same size as the Moon when viewed through solar-viewing glasses? *The Sun is tens of millions of miles away from the Earth, while the Moon is only hundreds of thousands of miles away from the Earth. The Sun is much further away from the Earth than the Moon.*
- What is an easy way to remember the planets? *Use the simple mnemonic "My very educated mother just served us nine pizzas." (Note: Pluto is no longer considered to be a planet.)*

## ASSESSMENT ACTIVITIES

- Exploring Planet Sizes Worksheet: Voyage of Discovery Worksheet, pages 33 and 34 of Lesson; answer key provided on page 32.
- Walking Planet Distances Worksheet, page 36 of Lesson; answer key is provided on page 32
- Solar Pizza: questions are integrated into the lesson and require a correct answer from a list of possible answers before being able to proceed further

## ENRICHMENT

- JPL Solar System Simulator: A Web-based activity providing students an opportunity to change a variety of variables to observe the current position of the planets of the solar system from different angles and perspectives. <http://space.jpl.nasa.gov/>
- SOHO: Observe a near real-time view of the Sun using data from the SOHO spacecraft. [http://sohowww.nascom.nasa.gov/data/realtime/hmi\\_igr/512/](http://sohowww.nascom.nasa.gov/data/realtime/hmi_igr/512/)
- JPL KIDS: A Web site containing a wealth of fun games and activities dealing with the solar system. <http://www.jpl.nasa.gov/kids/index.cfm>